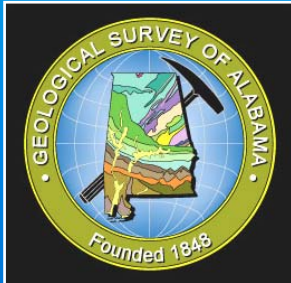


Fifth Annual Conference on Carbon Capture & Sequestration

Steps Toward Deployment

Geologic Storage - Coal Seams

**Using Discrete Fracture Network Models to
Assess Risks Associated with Carbon
Sequestration in Coal of the Black Warrior Basin**



Jack C. Pashin and Guohai Jin
Geological Survey of Alabama

SECARB
Coal Group

May 8-11, 2006 • Hilton Alexandria Mark Center • Alexandria, Virginia

ACKNOWLEDGMENTS

**U.S. Department of Energy
National Energy Technology
Laboratory**

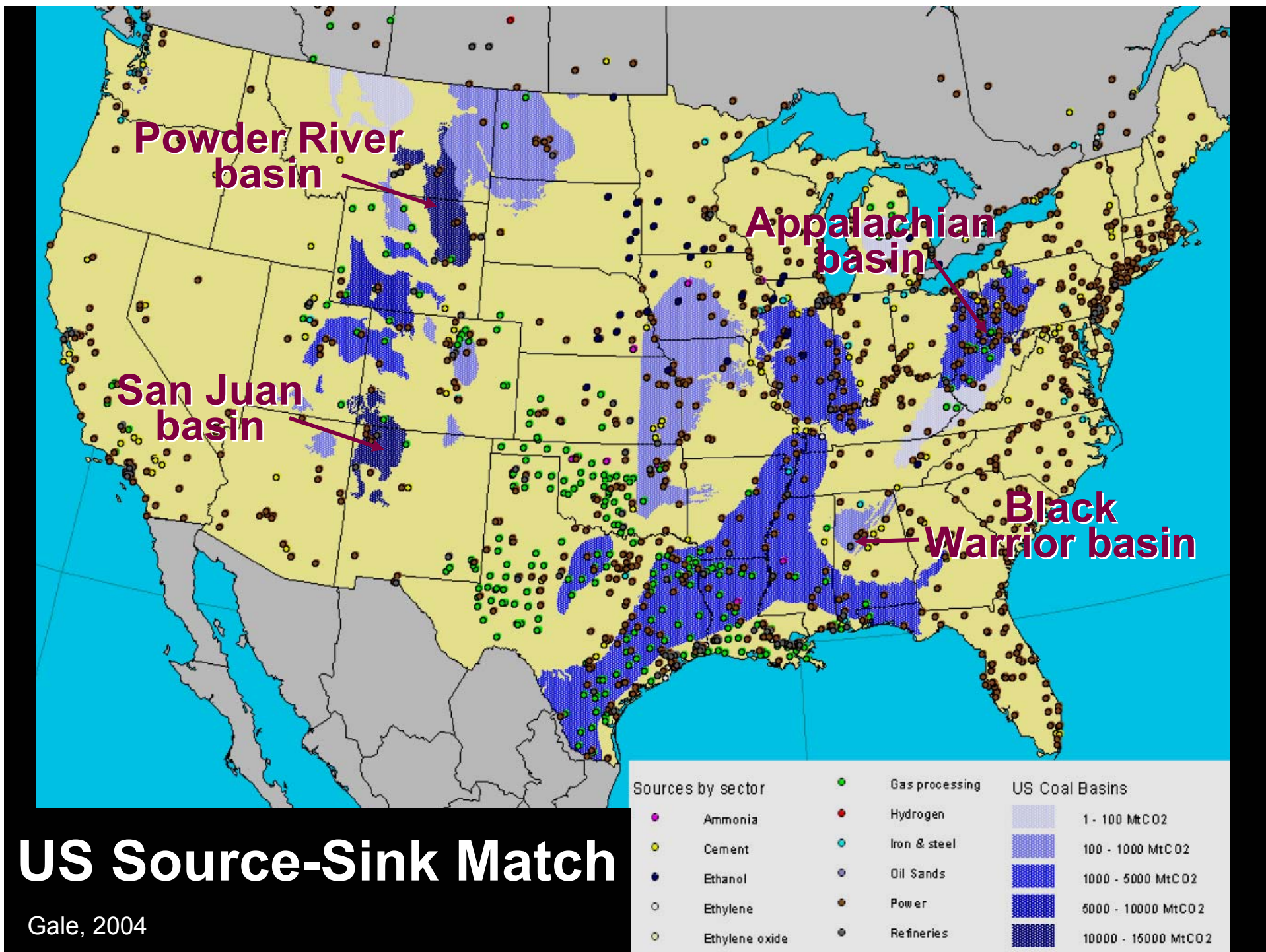
**Jim Walter Resources
SECARB
EPA Region 4**

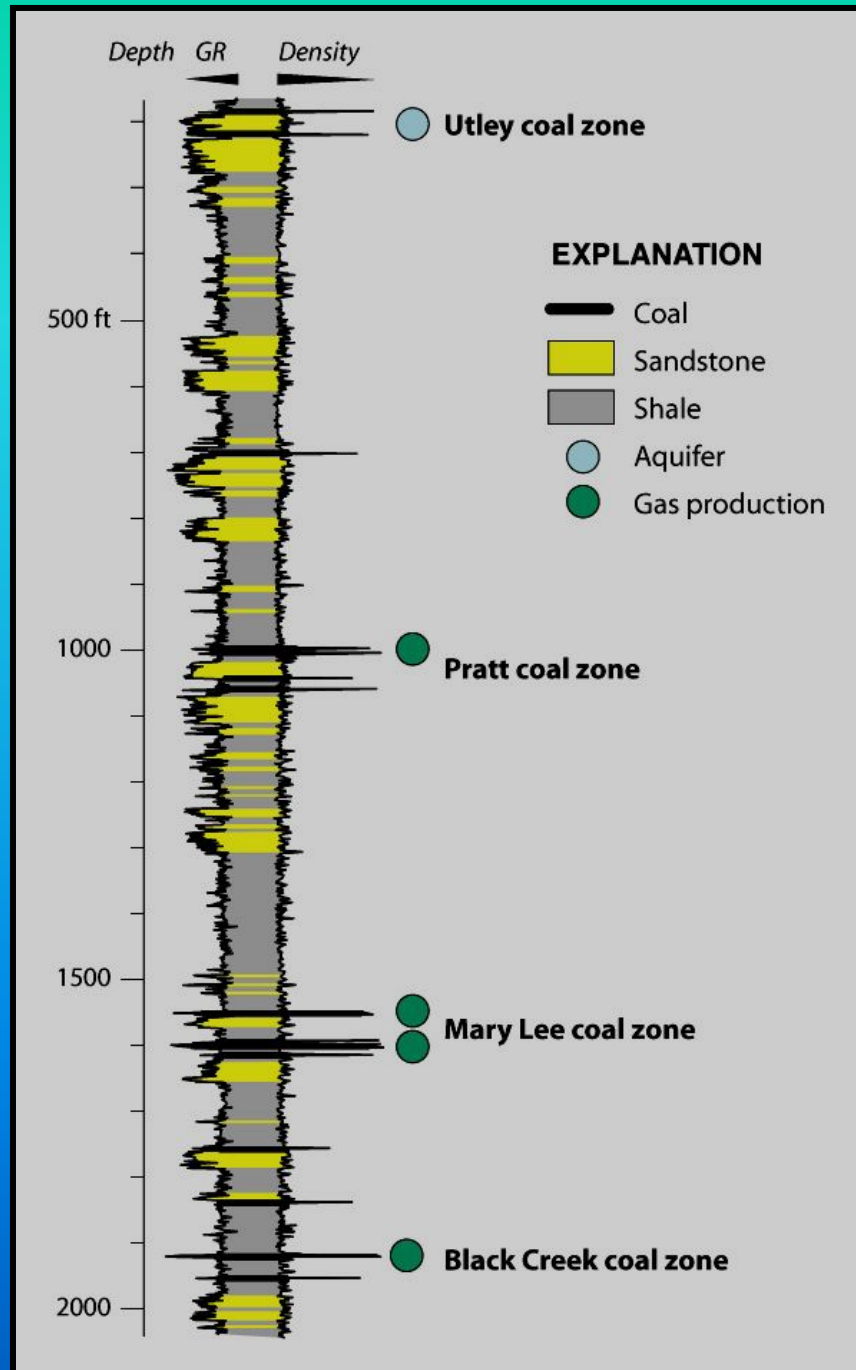
APPROACH

Well, Core, Outcrop Data

DFNModeler (structure)

TOUGH2 (flow)





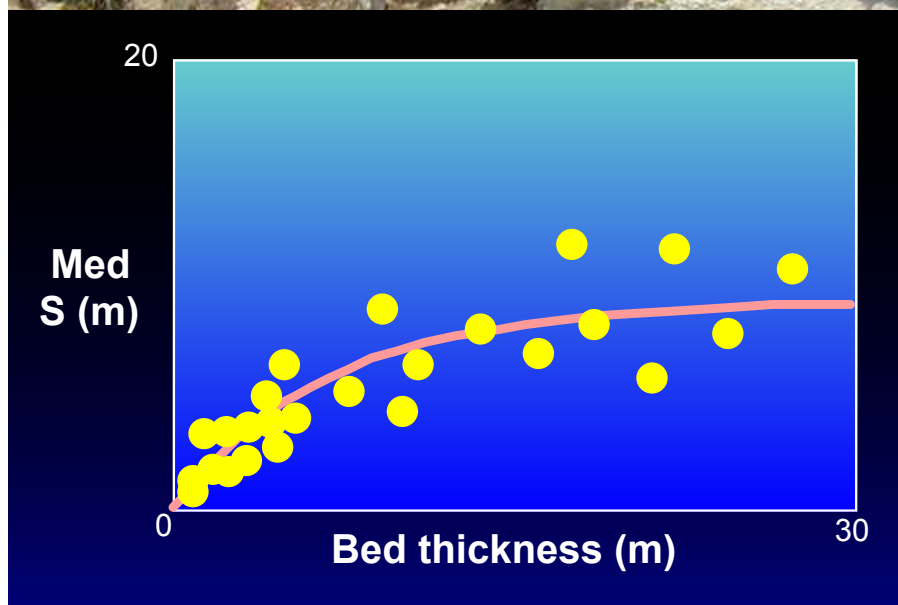
POTTSVILLE FORMATION

Cassidy 30-2-119
Blue Creek Field
Tuscaloosa Co., AL

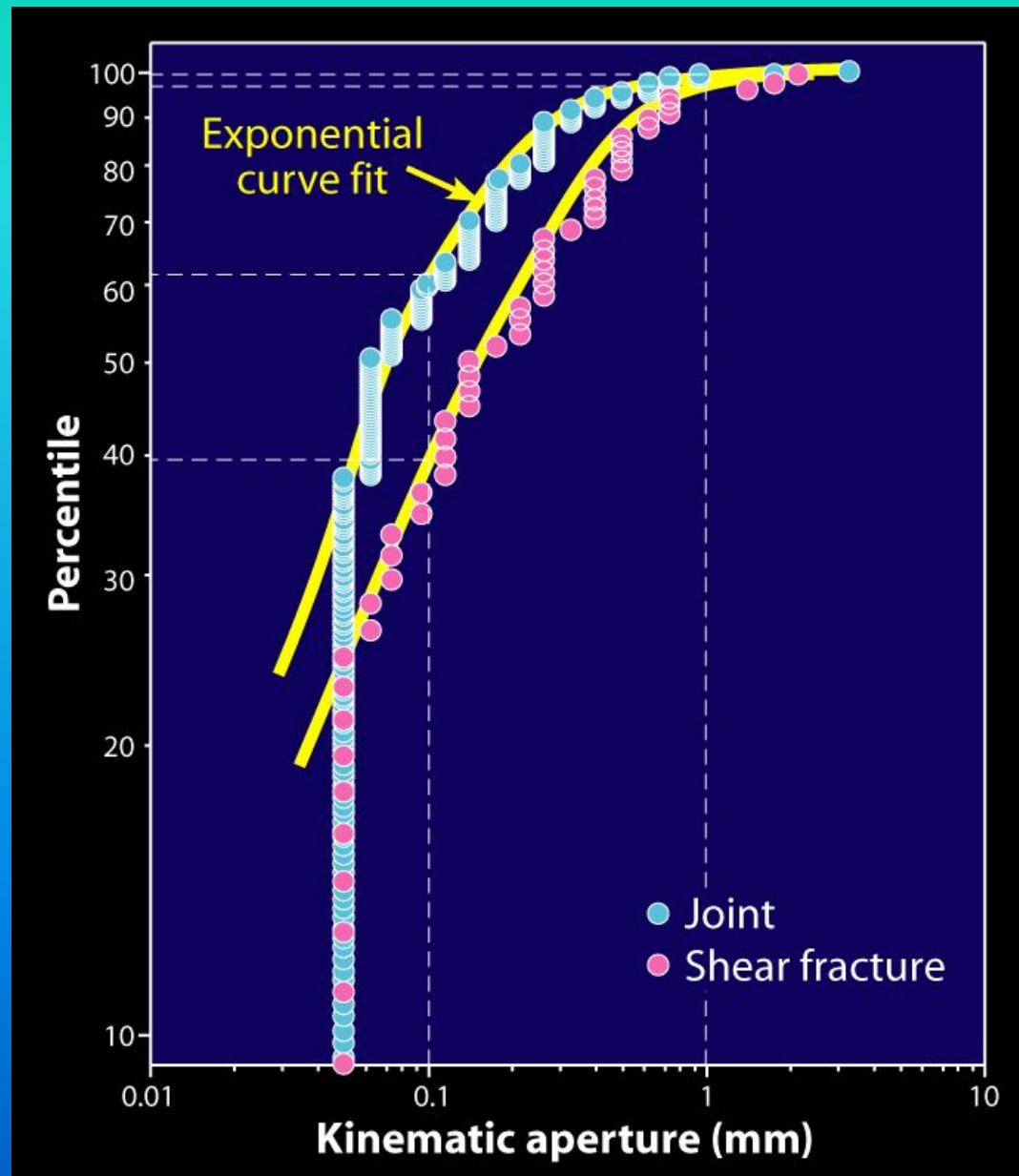
FAULTING AND FRACTURING



STRATA-BOUND FRACTURES



KINEMATIC APERTURE



PRIMARY CLEAT



DFNModeler INTERFACE ELEMENTS

The screenshot displays the DFNModeler software interface. The main window, titled "Discrete Fracture Network Modeler - [DFNModeler1]", shows a menu bar with File, Edit, Data, Model, View, Window, and Help. The View menu is open, showing options like Control Bars, Toolbar, Status Bar, Windows XP Style Menu, Imported Fracture Files, DFN Model, and Edit/View Mode. The DFN Model sub-menu is expanded, showing Points, Fractures, Regions, Compartments, Pathways, and Wells. The Stratigraphic Data dialog is open, displaying a table of stratigraphic units. The Fracture Data Dialog is also open, showing the Fracture Set List and various parameters for the selected fracture set.

Stratigraphic Data

#	Name	Unit	Lithogy	Thickness	Notes
1	GY shale1	Gillespy coal zone	Shale	22.0	Marine zone
2	ML Sandstone 3	Mary Lee coal zone	Sandstone	6.7	Top Mary Lee coal zone
3	ML Shale 4	Mary Lee coal zone	Shale	4.9	
4	ML Sandstone 5	Mary Lee coal zone	Sandstone	3.3	
5	Mary Lee Coal	Mary Lee coal zone	Coal	0.3	Perforated
6	ML Shale 3	Mary Lee coal zone	Shale	1.2	Middleman
7	Blue Creek Coal	Mary Lee coal zone	Coal	1.7	Perforated
					Underclay

Fracture Data Dialog

Fracture Set List:

- Mary Lee Coal
- Set 1: Cross Fractures
- Set 1: System Fractures
- Set 2: Cross Fractures
- Set 2: System Fractures

Location Model:

Region: Mary Lee Coal [Assign] [Create]

Orientation:

Trend: 62 Dip: 90 Distribution: Normal

Termination %: 100

Std Dev. 1: 5

Std Dev. 2:

Spacing:

Distribution: Normal Mean: .015 m

Std Dev.: .007 m

Fracture Size:

Length:

Distribution: Normal Mean: 28 m

Std Dev.: 6 m

Height:

Distribution: Constant Mean: 0.3 m

Std Dev.: 0 m

Fracture Properties:

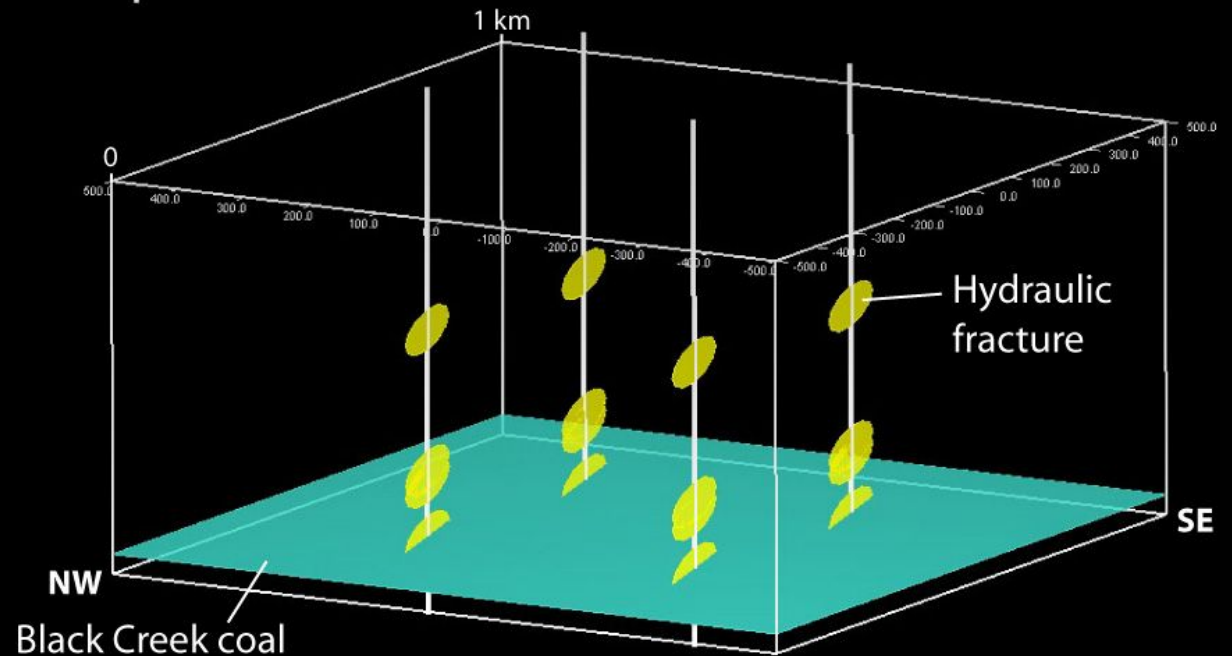
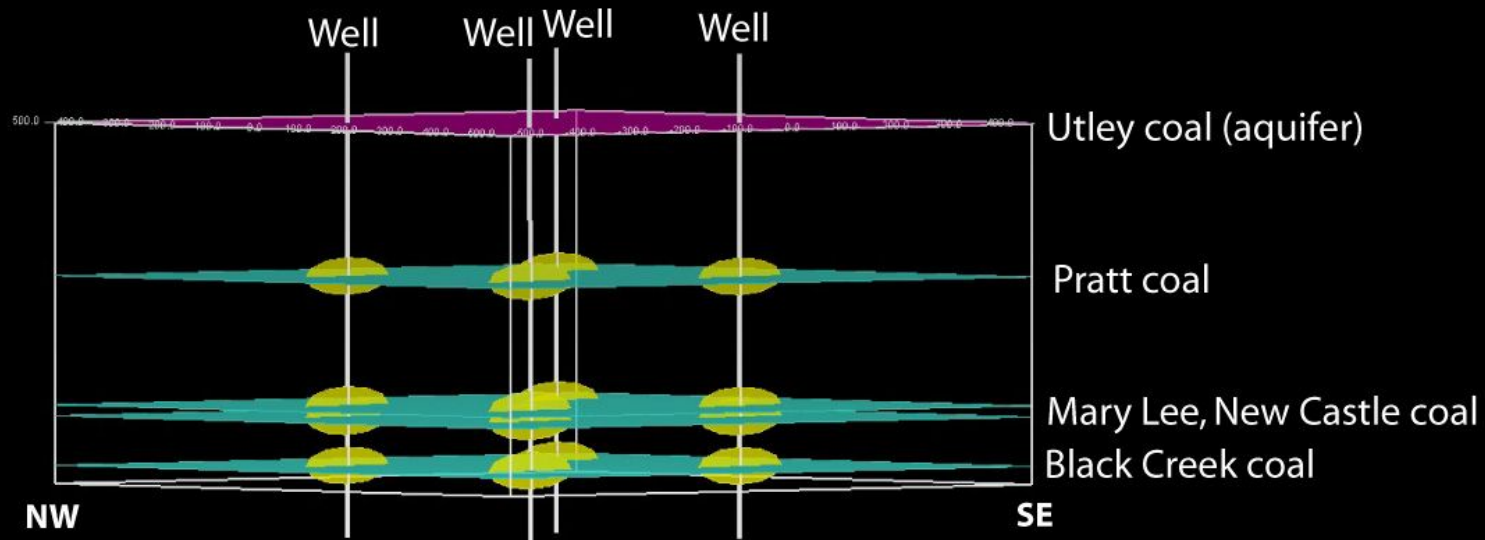
Fracture Aperture Distribution: Normal

Transmissivity Mean: .0005

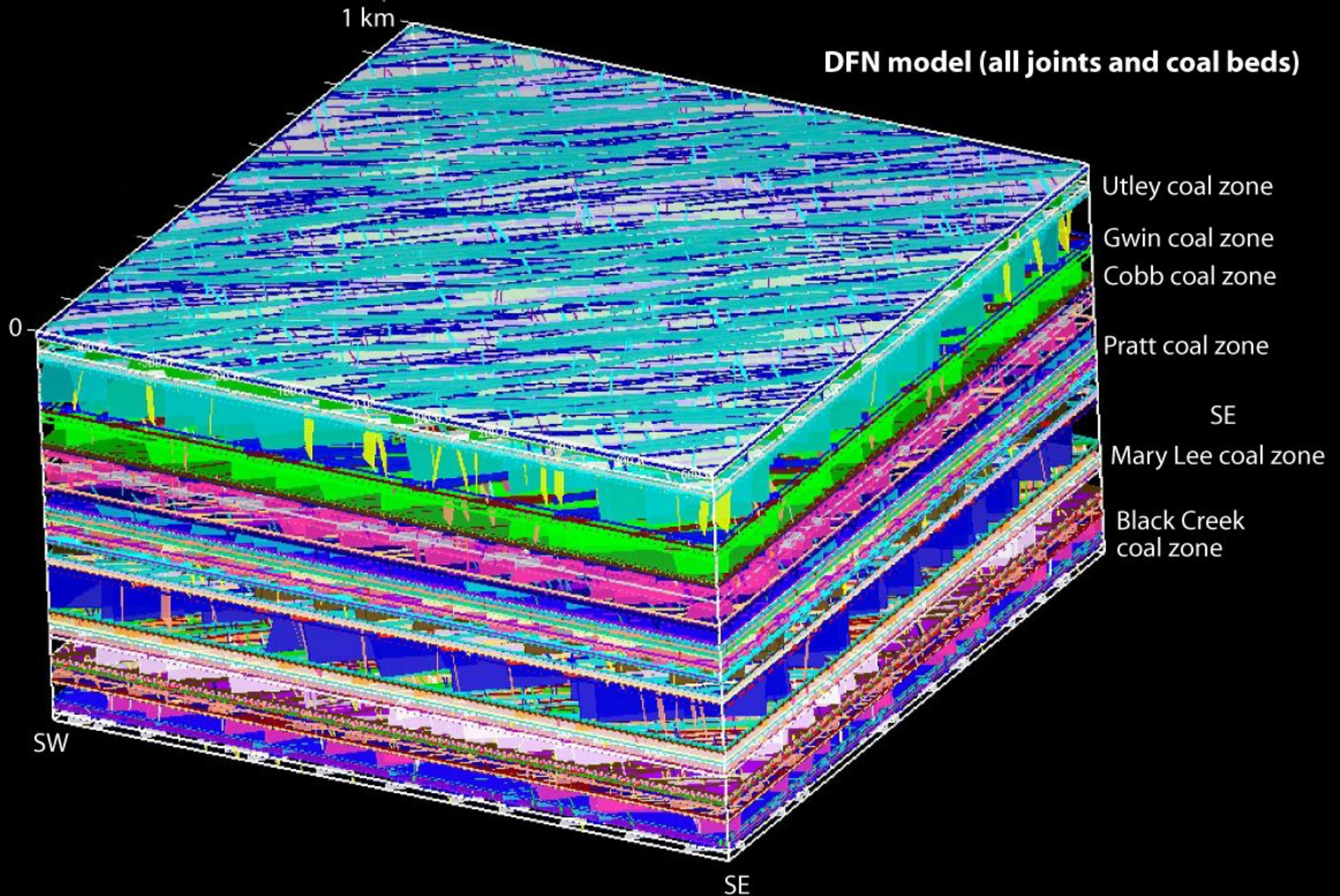
Storativity Std Dev.: .0002

[Create Fracture Set] [OK] [Save Data] [Cancel]

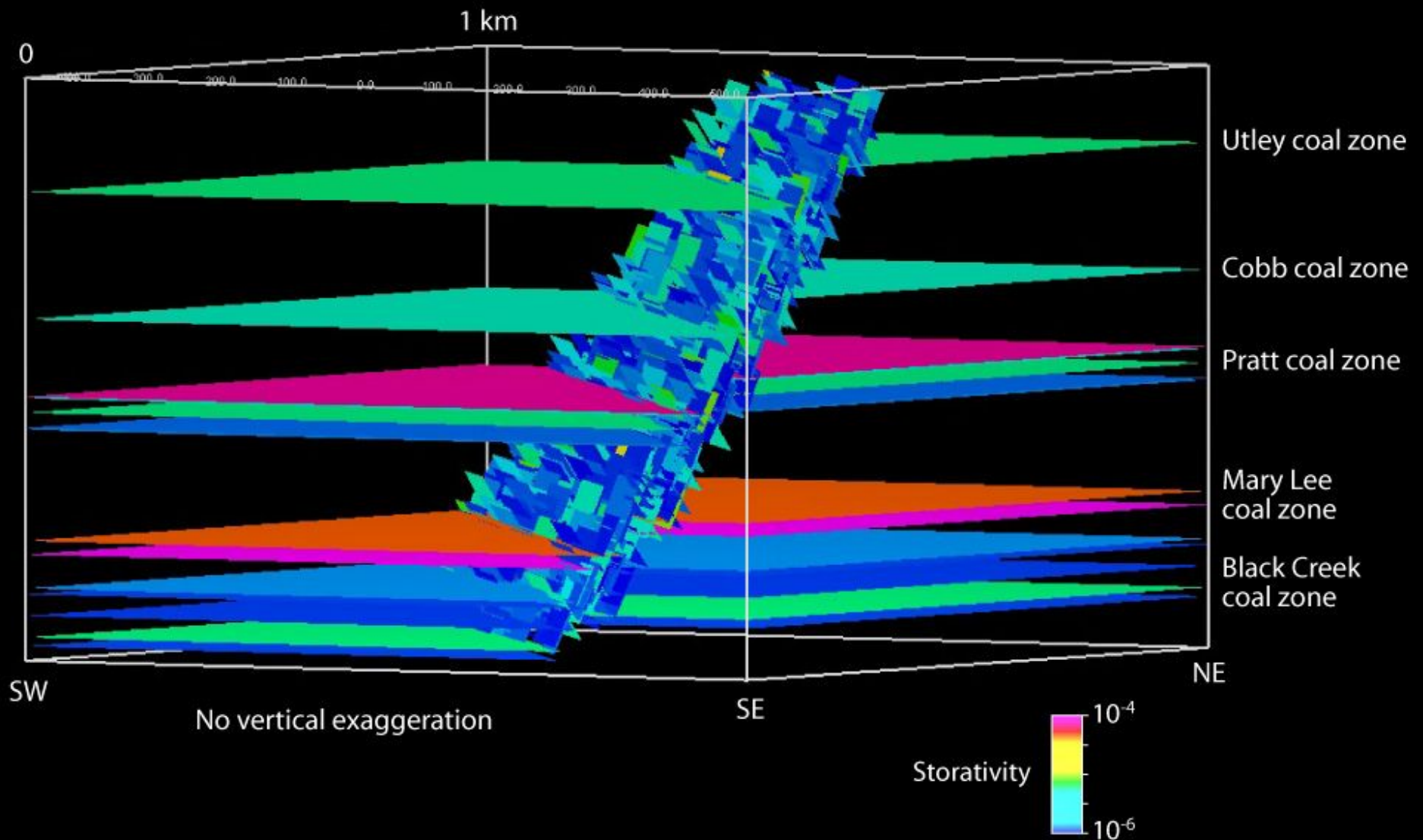
HYDRAULIC FRACTURES AND COAL



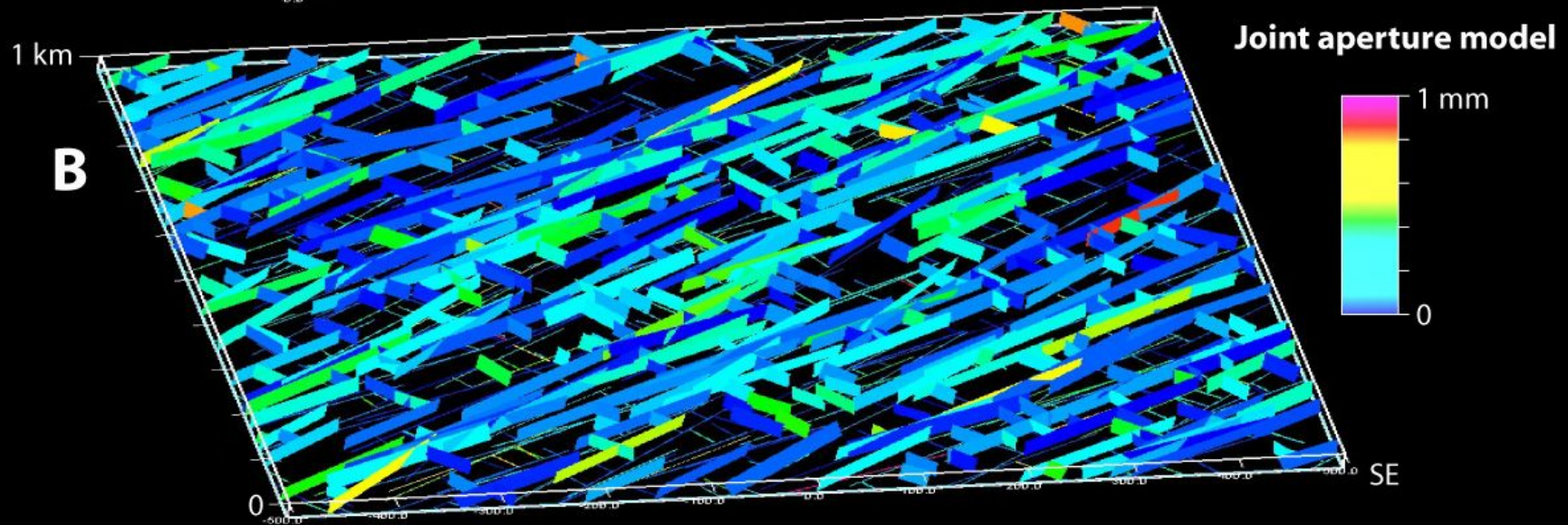
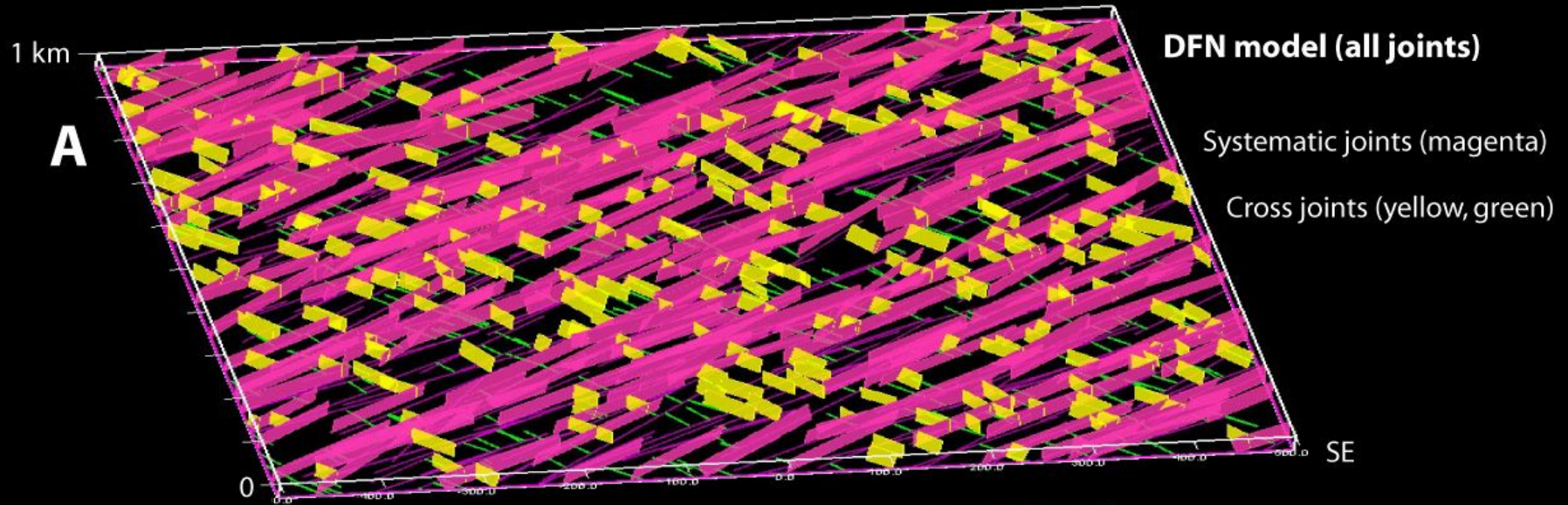
JOINTED DFN MODEL



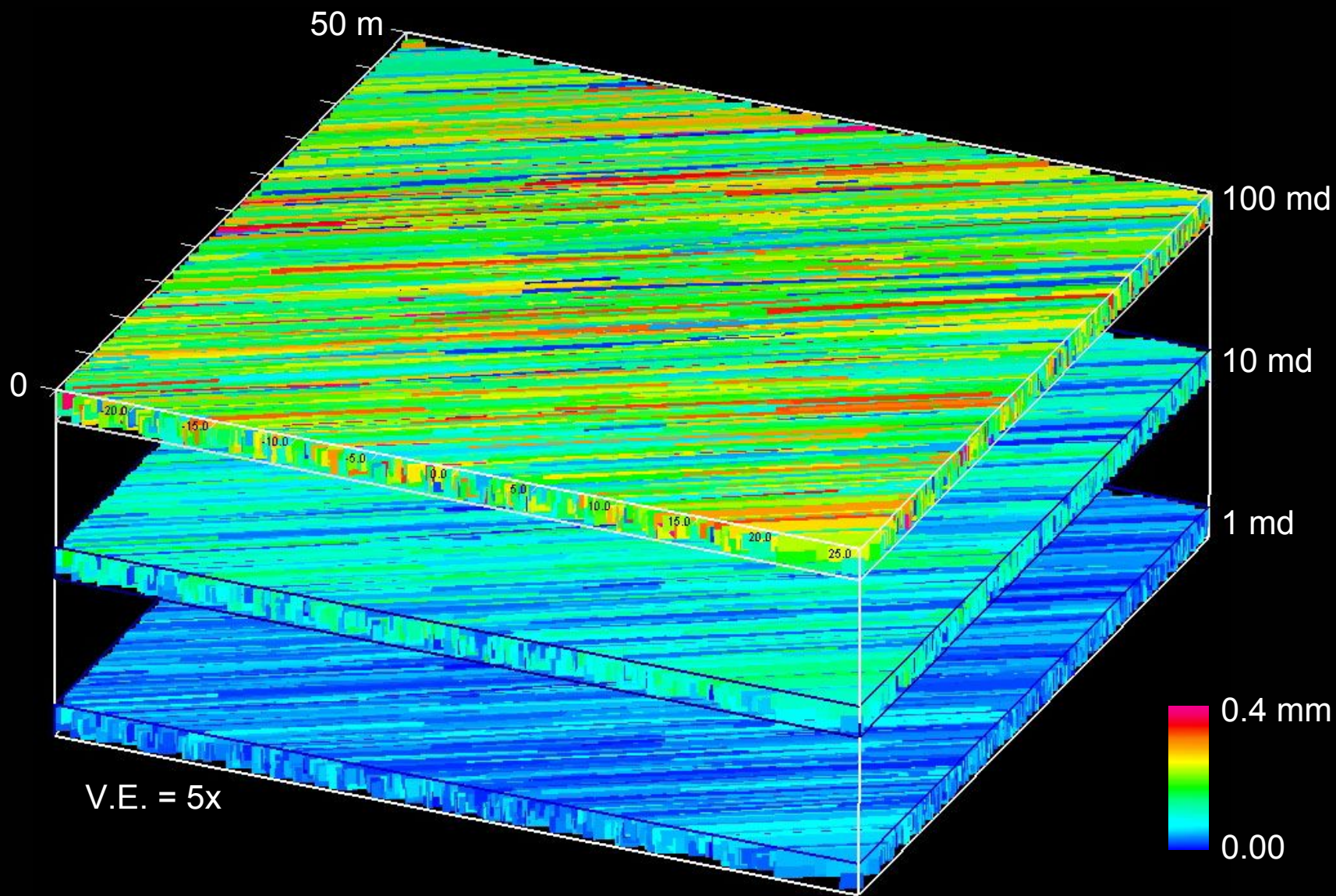
FAULTED DFN MODEL (STORATIVITY)



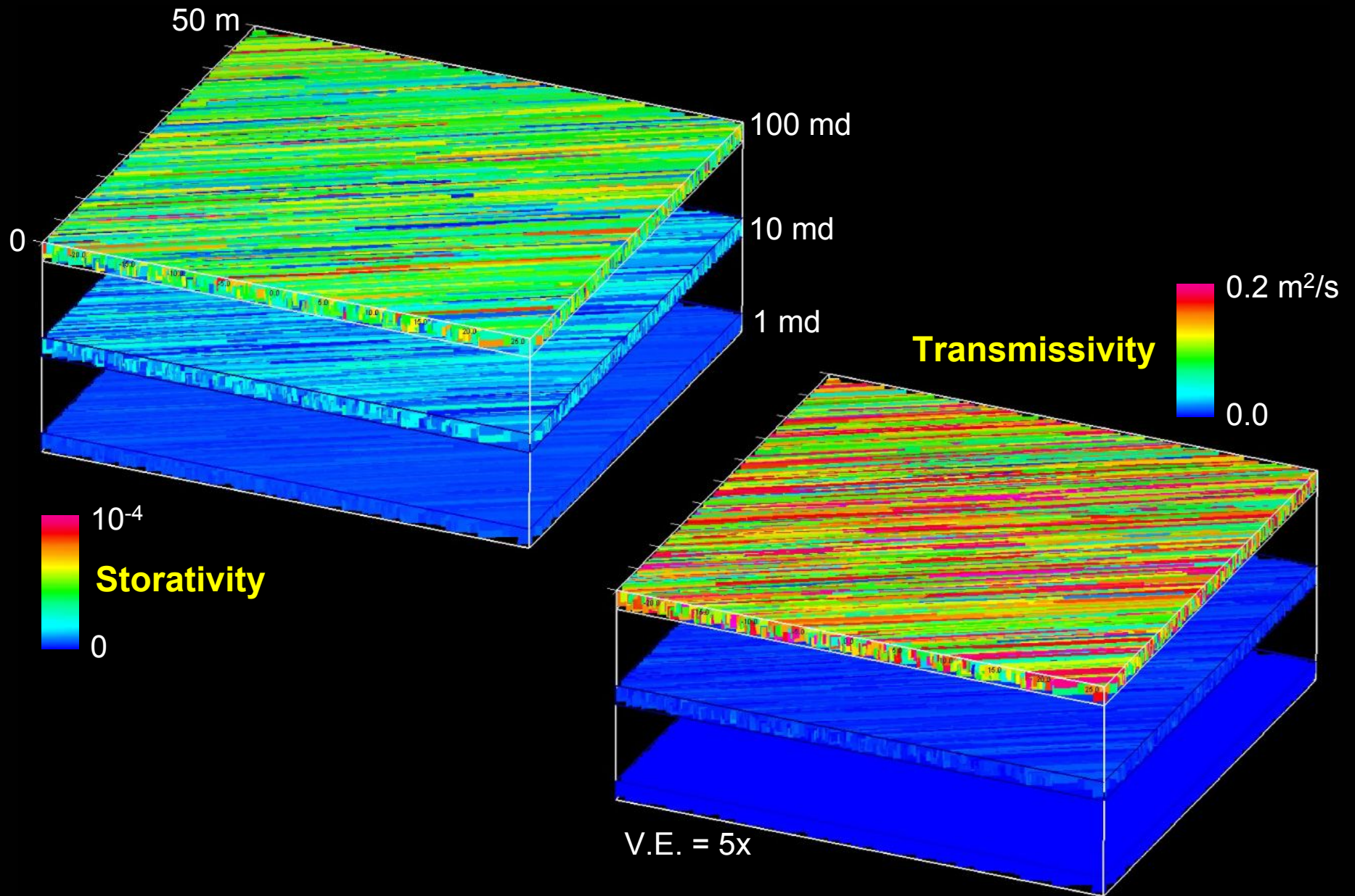
JOINT MODELS



FACE-CLEAT APERTURE

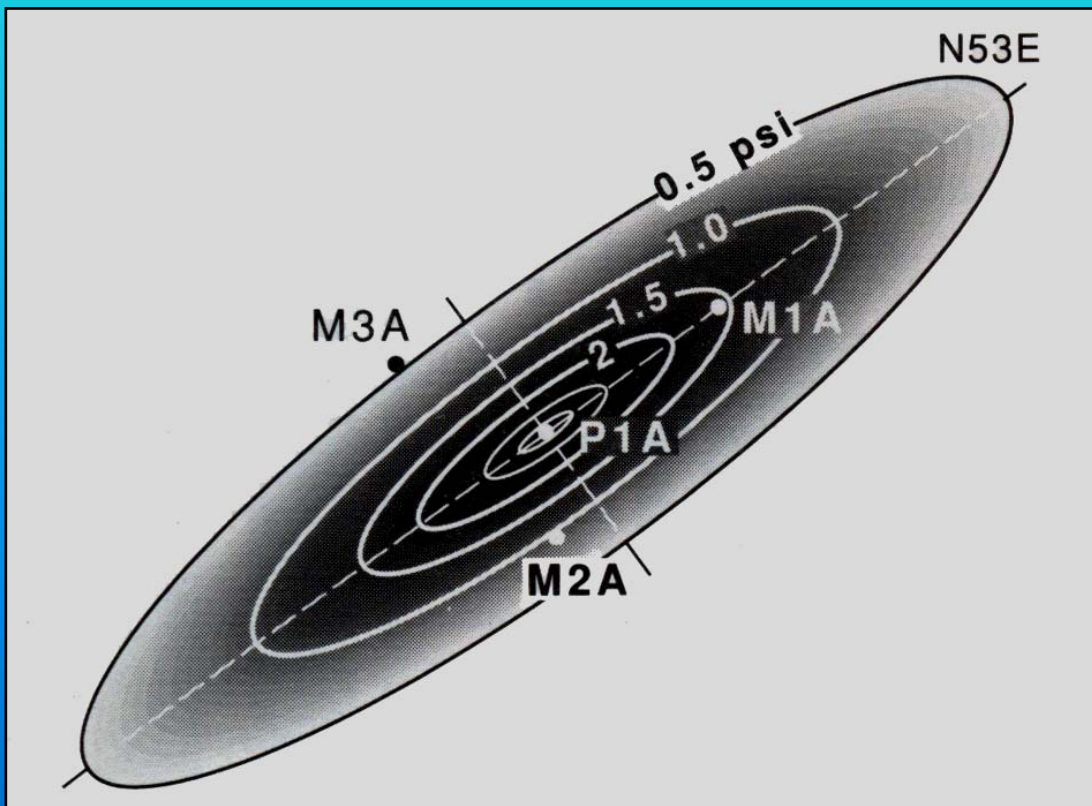


STORAGE AND TRANSMISSIVITY

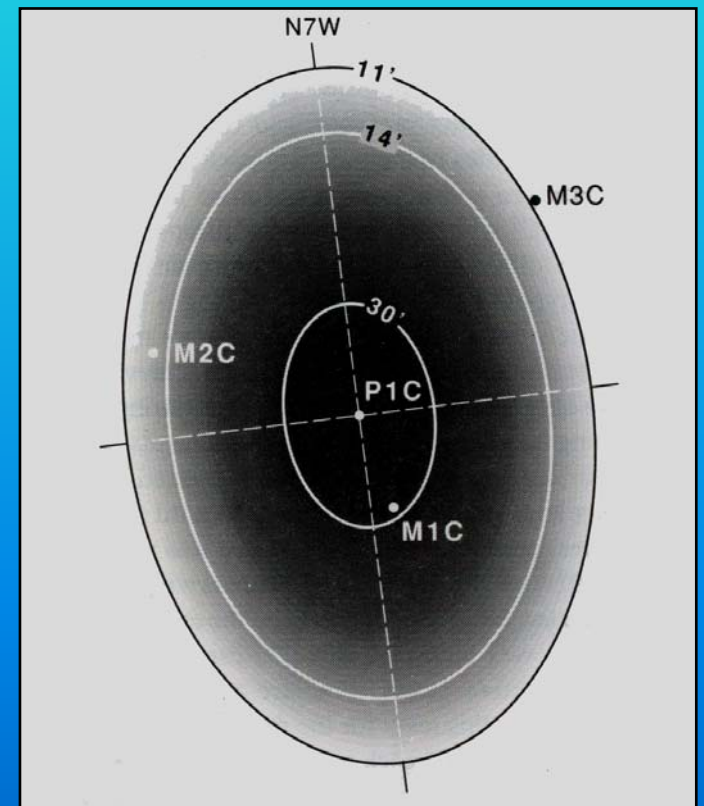


ROCK CREEK PRESSURE BUILDUP TEST RESULTS

PRATT COAL

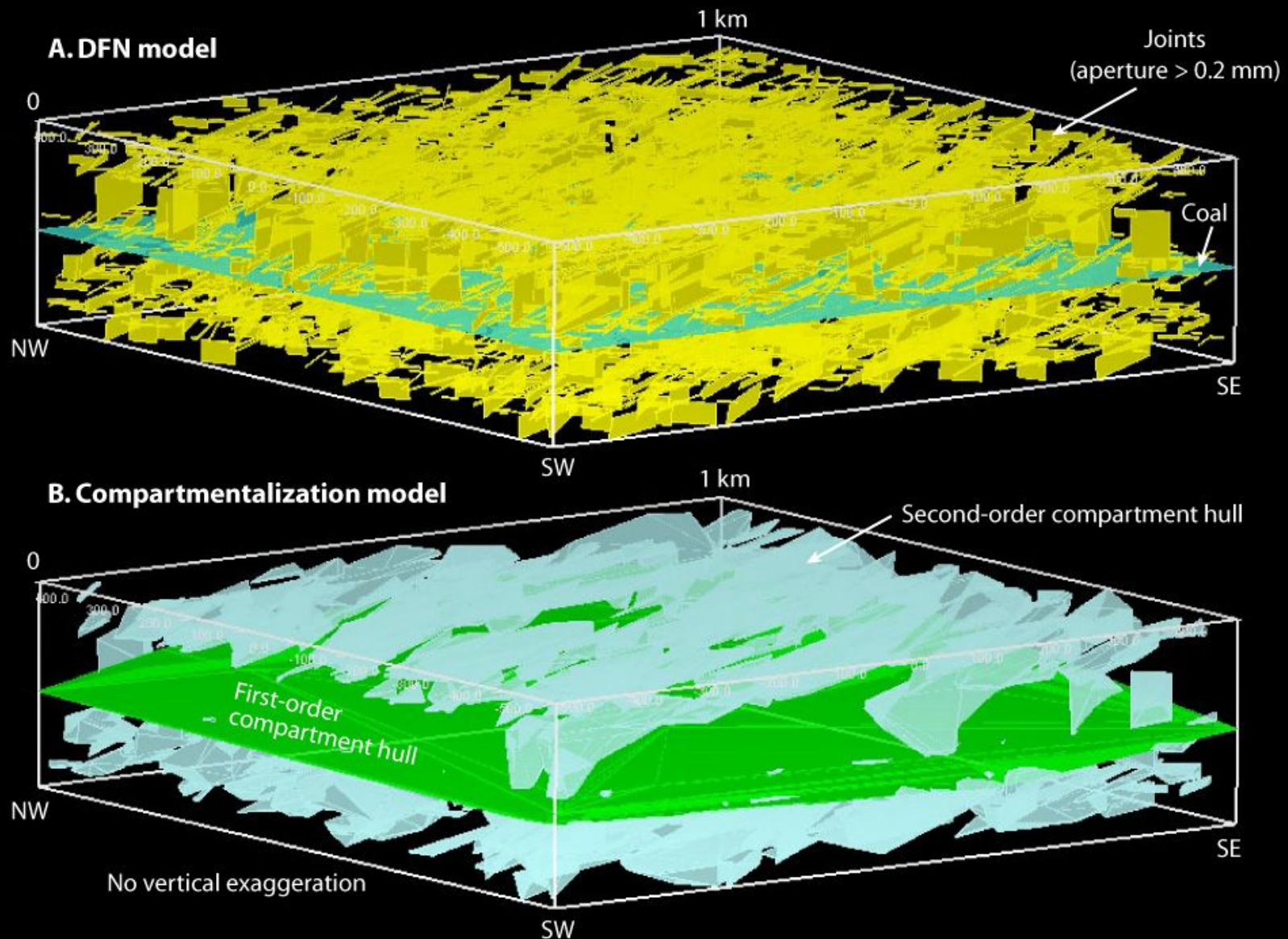


BLACK CREEK COAL



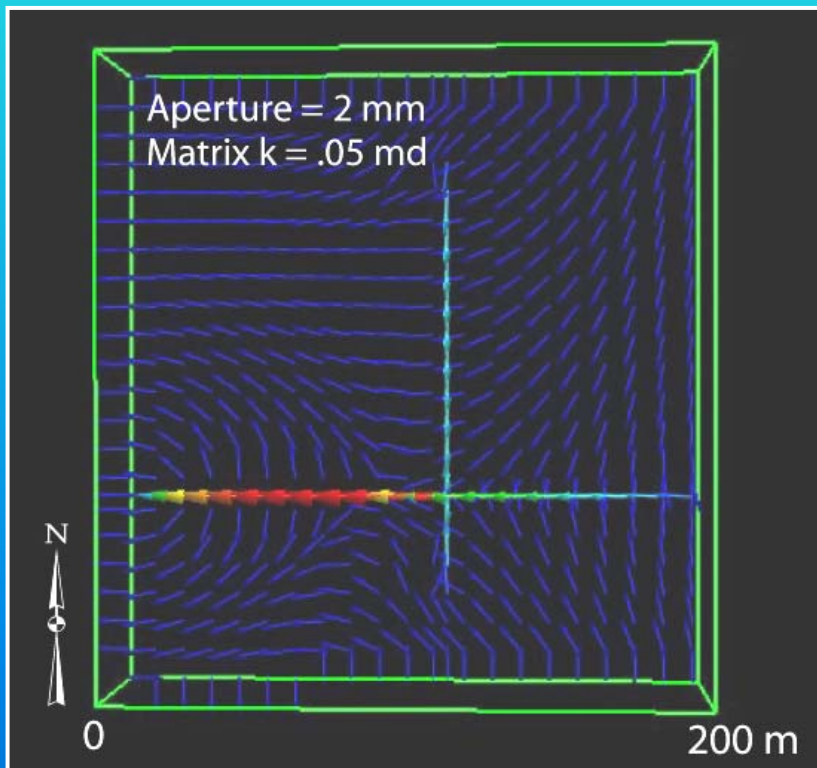
Koenig, 1989

COMPARTMENT MODEL

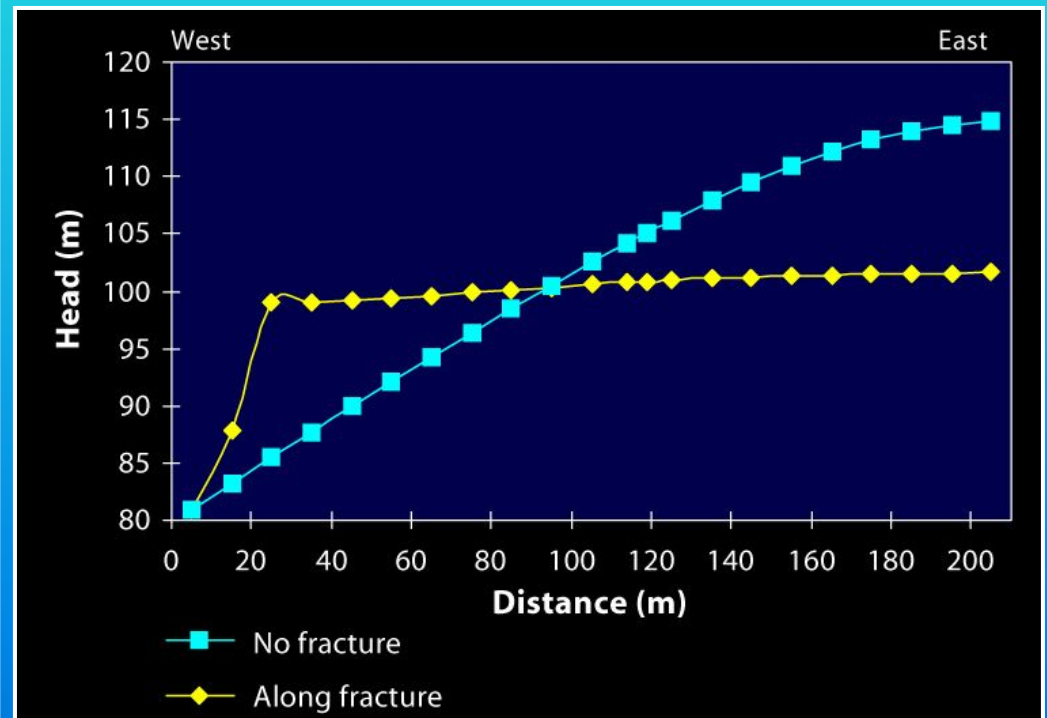


PRELIMINARY TOUGH2 MODELS

A. Flow model



B. Head profiles



WRAP-UP

Pottsville fracture systems follow statistical scaling rules that facilitate DFN modeling.

DFNModeler software shows promise as a risk assessment tool for carbon sequestration.

Two years remaining in study - visualization and analysis capabilities being enhanced, modeling to focus on SECARB Black Warrior coal site.